REMARKS

The inventors would like to thank that Examiner for meeting with them and their attorney on February 12, 2008. During the interview, the inventors discussed how the invention overcomes the problems that were present in the prior art. Specifically, the inventors indicated that the use of fiber glass fibers in their post is not an obvious variation of the Reynaud patent (5,328,372). The Reynaud patent uses carbon fibers that have a significantly higher modulus of elasticity than the fiberglass fibers used in the applicant's invention. The Reynaud patent provides that the post has "an average" transverse modulus of elasticity of "21 GPA in the angular range of 0°to 20°" (see column 2, line 7) . The angular stress "is the most frequent case during the high stresses of chewing, those which provoke cracks and fractures at the instant when one grinds the food before the return into centered position". Since the modulus of elasticity of dentin is less than the values provided in Reynaud, this difference between the modulus of elasticity of the carbon fibers and the dentin will result in a fracture of the tooth structure in times of increased stresses. Applicant's invention provides for a post that has a modulus of elasticity that approximates the modulus of elasticity of the natural tooth dentin or is less than that of natural tooth dentin. This has several advantageous. First, the fact that the modulus of elasticity of the present invention is closer to the modulus of elasticity of tooth dentin results in a post system that is more flexible than carbon fibers. The post relieves stress concentration within the tooth structure by shifting of stress concentration away from an apical end of the tooth under excessive tooth force loads to a coronal end of the tooth. This provides a dental post and core system that reduces the mechanical weakening of the tooth structure. Since the flexibility of the fiberglass fibers closely mimics the flexibility of the natural tooth, fractures are further reduced in the tooth structure. Secondly, a post having a modulus of elasticity close to that of the natural tooth structure provides a post structure that would be sacrificed during extreme stresses to the tooth structure and result in saving the tooth. The inventors also briefly discussed the new claims directed to the limitation that the fibers are medical grade optical fibers. Although the prior art discloses the use

of optical material in a tooth structure, the prior art does not teach or disclose the use of medical grade optical fibers in a dental post structure.

Claims 33, 55, 77, and 78 have been amended to remove the phrases "tooth-force vectoring" and "wherein said force vectoring comprises dissipation of energy by shifting stress under excessive tooth force loads, for saving a force overloaded tooth and further wherein". Applicant submits that the phrase "post having a flexibility approximating the flexibility of a natural tooth structure" is supported by the present application (see published application 2002/0123023 paragraph [0146]. The phrase "said post having a modulus of elasticity approximating the modulus of elasticity of a natural tooth structure" is also supported by the present application (see published application 2002/0123023 paragraph [0089]. Applicant has added the limitations of "said post relieving stress concentration within the tooth structure by shifting the stress concentrations away from an apical end of the tooth under excessive tooth force loads to a coronal end of the tooth". Support for this amendment is found throughout the application (see published application 2002/0123023 paragraphs [0016], [0069], [0086], and [0144]). Applicant submits that no new matter was added by these amendments.

Applicant has added new claims 105-108. The claims are similar to the claims that are currently pending with the addition of the use of "medical grade optical fibers". Support for this addition is provided in the present application (see published application 2002/0123023 paragraph [0084] and [0090] and Abstract). Applicant submits that no new matter was added in these new claims.

Claims 33-35, 38-40, 42, 44-46, 50, 52-61, 64, 65 and 70-104 stand rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirements. As provided above, claims 33, 55, 77 and 78 have been amended to overcome this rejection. Applicant submits that this rejection has been overcome and that the claims are in condition for allowance.

Claims 33, 35, 38, 42, 44-46, 50, 53-61, 64, 65, 70, 71, 74-82, 84, 85, 88, 89 and 91-103 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud (5328372) in view of Albert (5564929). The Examiner has asserted that the Reynaud patent could be modified to include the glass fibers as suggested by Albert. For at least the following reasons, Applicant submits that there is no motivation to combine these two references:

1. The Alpert reference should be removed as a reference since the earliest filing date of the present application pre-dates the filing date of the Alpert reference.

The present application has an earliest filing date of September 27, 1993 and issued as U.S. Patent No. 5,518,399. The Alpert reference has a filing date of August 17, 1994. As provided by the Examiner, the Alpert reference is used to modify Reynaud to include the use of glass fibers in order to "make use of known alternative materials in order to obtain the desired known properties of those materials". However, the earliest filed application from the current inventors teaches glass fiber composites (see column 5, lines 54 and 64). Since the limitation directed to glass fibers is provided in the parent application, Applicant submits that it is entitled to the benefit of the earliest priority date. Therefore, Applicant submits that it is improper for the Examiner to use the Alpert reference to teach "known alternative materials" such as glass fiber as provided in the present invention since the effective date of the Alpert reference is after the earliest filing date of the present application.

2. Fiberglass fibers provide unexpected and superior advantages over carbon fibers that are not disclosed in the prior art.

Because the dental peg in Reynaud uses carbon fibers, the peg has a higher modulus of elasticity than tooth dentin providing pegs that are less flexible and less capable of absorbing the stresses that are involved during the use of the post system. During extreme stress, the tooth structure would fracture and the peg would likely remain intact. Although this would save the dental peg, the tooth would be sacrificed resulting in additional surgery and replacement of the tooth structure. Applicant has unexpectedly discovered that dental posts that include fiberglass fibers have

unexpected benefits over posts that include carbon fibers. When fabricating a dental post with fiberglass fibers, a post can be formed that has a modulus of elasticity that approximates the modulus of elasticity of the natural tooth. This is a very important property when applying a post to a tooth structure. The similar modulus of elasticity values will reduce the likelihood of fracture of the tooth during normal use. Additionally, the post structure would be sacrificed during extreme stresses to the tooth structure and ultimately save the tooth for further repair. Contrary to the assertion that Albert teaches that carbon fibers and fiberglass fibers are "known alternative materials" that would "obtain the desired known properties of those materials", Applicant has unexpectedly discovered that there are several benefits to using fiberglass fibers in the post structure as compare to using carbon fibers.

Applicants assert that one of the problems with making carbon fiber composites is that the carbon fibers are slippery and it is difficult to adhere the carbon fibers to the resin. As provided in the attached Power Point Presentation found on-line at www.cs.berkeley.edu/~jfc/DR/F03/lectures/lec13/lec13.ppt, carbon/graphite fibers are diametrically different than glass fibers. Carbon fibers have the same structure as (soft) graphite. This inherent structure in carbon fibers results in a slippery fiber that is difficult to work with in the composite industry. Applicants have surprising found that glass fibers adhere to the resin more easily and do not have the same type of slippery property found in carbon fibers. This physical property found in glass fibers, as used in the present invention, provides a superior composite over previously used carbon fiber based composites.

3. The prior art does not provide any teaching that fiberglass fibers would provide a dental peg that has a modulus of elasticity close to that of dentin.

Although the Reynaud patent may suggest that it is desirable to provide a dental post that has a modulus of elasticity close to that of dentin, it does not provide any suggestion that a material other than carbon fibers would produce the desired result. Column 2, lines 1-12 provides modulus of elasticity data for dental posts that specifically include "high performance carbon fibers". The Examiner relies on the Albert

reference to teach that carbon and glass fibers are "known alternative materials". However, the Albert reference provides a list of at least a dozen fibers that may be acceptable in the prosthesis device taught in Albert. There is no teaching or suggestion that any one of these 12+ fibers would provide the unexpected advantages of the presently claimed invention. Applicant submits that extensive research and experimentation would have to be conducted on all the fibers provided in Albert in order for anyone to discover the beneficial properties that result from Applicant's claimed invention.

4. None of the prior art references teach a dental post having a modulus of elasticity that is less than or equal to that of dentin as provide by claims 93-96

Applicant submits that the Reynaud patent teaches a dental post having a modulus of elasticity close to, but greater than, that of natural tooth dentin. Neither the Reynaud nor the Albert reference teaches a dental post that has a modulus of elasticity that is less than or equal to that of dentin. As described above, this property is very important in maintaining the integrity of the tooth. The claimed dental post reduces the mechanical weakening of the tooth structure by relieving stress concentrations at the apical end of the post. By using a dental post that has a modulus of elasticity less than or equal to that of dentin, the post will be sacrificed during extreme stresses and the tooth structure will be saved. This will result in fewer surgeries and maintain the usefulness of the tooth structure.

5. The Reynaud patent does not disclose a post that has a modulus of elasticity approximating that of natural tooth dentin

As provided in the Reynaud reference, the average "transverse modulus of elasticity" for the dental peg is 21 GPa (see column 2, line 7). This average ***transverse*** modulus of elasticity is based on "8.5 GPa for an angle of application of the traction effort, with respect to the transverse direction, of 0° and a value of 34 GPa for an angle of 20° which gives an average of 21 GPa in the angular range of 0° to 20°". Although

the Reynaud patent submits that this value is close to the modulus of elasticity of dentin, this is still significantly higher than the actual value for tooth dentin.

Fiber reinforced composites have a mechanical property called "anisotropy". This is well documented in material science text books. Anisotropic materials have different values when measured in different directions. Applicant submits a 132 Declaration from Dr. Lawrence Brecht providing evidence that the Modulus of Elasticity on dental posts as measured by an INSTRON machine is performed using a vertical pull. Using a vertical pull means that fibers engage more vs. transversely where more resin and less fiber engage the forces. Therefore, the transverse values by definition will be lower due to innate material properties. In order to report consistent values for materials the vertical methods afforded through the use of an Instron machine are generally employed in dental materials testing. For reinforced composites (such as those made of resin and fiber) applying the testing force at transverse angles other than a vertical orientation would incorporate more resin and less fiber into the results and should not be considered the standard because in any transverse calculation the resin is the weakest link and will skew the results. Therefore the transverse modulus number as applied in Reynaud will always yield a lower modulus than the traditional Instron method.

Applicant also submits a paper entitled "The Mechanical Properties of Human Dentin: A Critical Review and Re-evaluation of the Dental Literature". This 2003 article provides that "over half a century of research has failed to provide consistent values of dentin's mechanical properties." The article teaches that dentin itself by virtue of its collagen and mineral and tubule content is both anisotropic and viscoelastic – just like fiber reinforced composites. The article shows that many different ways the Young's Modulus was calculated with very big differences in reported values. The article provides "tension" values for the dentin samples around 18.5 GPa aligning the tubules of the dentin or the fibers of the dentin in a specific way. When the orientation of the force is changed, that is, how the stress on the dentin is applied in relation to the strain; the value of the Young's Modulus changes also. This is the definition of anisotropy. The Reynuad patent provides for a "transverse modulus of elasticity of the dentine which is 18 GPa". However, Reynaud does not provide any details for how this

measurement was determined. It appear obvious from the attached 2003 article, that the anisotropic properties of the dentin require more detail in measurement parameters in order to define a modulus of elasticity for dentine. It is asserted that one of ordinary skill in the art would not understand what is meant by Reyanud's 18Gpa assertion for the modulus of elasticity. In reality, there is NO absolute value for the modulus of elasticity because of the multitude of variables in the samples of dentin. The Applicants do not limit the elasticity properties of their invention because they are aware of the range of values and the properties of the material. Fiber reinforced composites or any medical devices and biological devices need consistency in reporting and testing which begins with defining the experimental tests and properties in a meaningful and repeatable way. Reynaud failed to do this and is not enabling for this physical property for dentin.

Applicants also submit an article entitled "Mechanical behaviour of unidirectional fiber-reinforced polymer under transverse compression: Microscopic mechanisms and modeling". This article discusses compression perpendicular (or transverse) to the fibers. This article shows that fiber reinforced composites with longitudinal fibers react differently when subjected to stresses at varying angles. The article also teaches the inherent liabilities of fiber reinforced composites when stressed in a transverse mode as compared to the vertical pull or linear mode.

Applicant submits an article entitled "Elastic Properties and Young Modulus for some Materials" showing that glass fibers inherently have a lower modulus of elasticity than carbon fibers. Therefore, regardless of what type of testing is conducted to determine the Modulus of Elasticity, carbon fibers will test higher than glass fibers. Applicant submits that the disclosure in Reynaud teaching matching properties of the tooth including the modulus of elasticity based on carbon fibers would not direct one of ordinary skill in the art to substitute glass fibers. Applicant submits that carbon fibers and glass fibers are not known alternative fibers and have significantly different properties that would require extensive experimentation in order to determine whether the application of one of the fibers would be suitable for the other fiber.

5. There is no motivation to combine the reference.

The Examiner has indicated that one of ordinary skill in the art would "modify Reynaud to include the use of glass fibers as suggested by Albert in order to make use of known alternative materials in order to obtain the desired known properties of those materials". However, the Albert reference teaches that the "rope" has unique properties in that it allows "relatively minimal wall reduction of the root canal during preparation by virtue of the rope's ability to fit into and be conformed to the contour of the canal as compared to the relatively fixed and unyielding configuration of existing root canal posts" (see column 2, lines 42-47). The Albert reference further provides that the "rope" is made from fibers that are well known in the art.

Applicant submits that the Albert reference "teaches away" from using posts as claimed by the present invention. The Albert reference teaches that flexible rope-like devices have beneficial results over dental posts. Therefore, one of ordinary skill of the art would not use the teachings of Albert to modify the Reynaud reference directed to posts.

The fibers provided in the Albert reference are listed as fibers for making a "rope". Therefore, the fibers are selected based on their ability to "fit into and be conformed to the contour of the canal" and are analogous in this sense. However, neither the Albert nor the Reynaud reference teach or suggest that carbon fibers and glass fibers would be "known alternatives" with regard to flexibility and modulus of elasticity comparisons with natural tooth dentin. The Examiner has asserted that the glass fibers would be "inherently more flexible" to better match elasticity properties. However, the Alpert reference provides that "the density of the yarn" affects the flexibility of the rope (see column 3, lines 10-12). Therefore, the Alpert reference suggests that the density of the yarn determines the flexibility and not the type of fiber *per se.*

There is no suggestion to combine the teaching and suggestions of Alpert and Reynaud, as advanced by the Examiner, except from using Applicants' invention as a template through a hindsight reconstruction of Applicants' claims. Neither reference teaches are suggests that fiber glass reinforced plastic composites would have the

beneficial properties as provided, including a modulus of elasticity close to natural tooth dentin.

For at least the foregoing reasons, Applicant submits that the claims are now in condition for allowance and requests reconsideration and allowance of the application.

Claims 34 and 90 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert as applied to the claims above, and further in view of Kwiatkowski (4936776). Since claims 34 and 90 are dependent claims, Applicant submits that they are allowable for the above-identified reasons given for the allowability of the independent claims.

Claim 39 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert as applied to the claims above, and further in view of Al Kasem (5326264). Since claim 39 is an dependent claims, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 40 and 52 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert as applied to the claims above, and further in view of Weissman (5326263). Since claims 40 and 52 are dependent claims, Applicant submits that they are allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 72 and 73 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert and Al Kasem (5326264) as applied to the claim 39 above, and further in view of Fujisawa (4931096). Since claims 72 and 73 are dependent claims, Applicant submits that they are allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 83, 86 and 87 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert as applied to the claims above, and further in view of Fujisawa. Since claims 83, 86 and 87 are dependent claims, Applicant submits that they are allowable for the above-identified reasons given for the allowability of the independent claims.

Claim 104 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Albert as applied to the claims above, and further in view of Nordin (5282747). Since claim 104 is a dependent claims, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 33, 35, 38, 42, 44-46, 50, 53-61, 64, 65, 70, 71, 74, 77, 95 and 97-99 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg (4894012). As previously discussed, the Reynaud patent is clearly directed to a dental post system that uses carbon fibers in the post. The carbon fibers are substantially less flexible than the tooth dentin. This results in fracturing of the tooth structure during extreme stresses to the tooth. Although the Goldberg reference provides a list of fibers that may be suitable for use in a dental appliance, including glass, carbon and/or graphite, this reference does not suggest that such fibers would be suitable alternatives in a dental post application. An appliance that is used externally of the tooth structure, such as Goldberg, has inherently different structural concerns than a device that is inserted into the actual tooth structure. When a post is placed within the tooth structure, special attention must be taken into consideration regarding the effect of the post on the tooth and its susceptibility to fracture. As provided by the Examiner, the Goldberg reference teaches "common alternative materials" and "gives no criticality to the use of fiberglass". However, the Applicants have unexpectedly discovered that the use of fiberglass fibers is critically important because of the flexibility that is required to coordinate strength and flexibility with the tooth structure. Although it may be obvious to use a material that would approximately match the flexibility of a natural tooth in dental posts, neither the Goldberg nor the Reynaud patent teaches or suggests that fiberglass

fibers could accomplish this beneficial property. The Examiner is imparting this property to the fiberglass fibers by impermissibly using hindsight and Applicants own specification to arrive at his conclusion. The Examiner has provided no motivation other than applicant specification that would teach one of ordinary skill in the art that fiberglass fibers used in a dental post would match the tooth properties of the natural tooth structure. For the foregoing reasons, Applicant submits that the claims are in condition for allowance and requests reconsideration and allowance of the application.

Claim 34 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg as applied to the claims above, and further in view of Kwiatkowski. Since claim 34 is a dependent claim, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claim 39 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg as applied to the claims above, and further in view of Al Kasem. Since claim 39 is a dependent claim, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 40 and 52 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg as applied to the claims above, and further in view of Weissman. Since claims 40 and 52 are dependent claims, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 72 and 73 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg and Al Kasem as applied to the claim 39 above, and further in view of Fujisawa. Since claims 72 and 73 are dependent claims, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 75, 76, 78-82, 84, 85, 88, 89, 91, 96 and 100-103 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg as applied to the claims above, and further in view of Himmel (GB 2214087). Claims 78 and 101 are independent claims that include the limitations regarding the modulus of elasticity, flexibility, and stress relieving properties of the dental post. Applicant has provided several reasons that Reynaud and Goldberg can not be combined to obtain the post as claimed in the present application. Since Himmel is only used as a reference to teach twisting fibers, Applicant submits that the independent claims 78 and 101 are allowable for the same reasons as provided above during the discussion of Reynaud and Goldberg. The remaining claims are dependent claims and Applicant submits that they are allowable for the above-identified reasons given for the allowability of the independent claims.

Claims 83, 86 and 87 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg as applied to the claims above, and further in view of Fujisawai. Since claims 83, 86 and 87are dependent claims, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claim 90 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg and Himmel as applied to claim 78 above, and further in view of Kwiatkowski. Since claim 90 is a dependent claim, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Claim 104 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Reynaud in view of Goldberg and Himmel as applied to claim 102 above, and further in view of Nordin. Since claim 104 is a dependent claim, Applicant submits that it is allowable for the above-identified reasons given for the allowability of the independent claims.

Applicant has amended the claims of the present application to further define the invention. For the reasons provided above, Applicant submits that the claims are now in condition for allowance and respectfully request reconsideration and allowance of the application.

Respectfully submitted,

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